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LUMINARY Memo #31

To: Distribution

From: C. Schulenberg

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Subject: LUMINARY Revisions 19-26

LUMINARY Revision 19 was identical to Revision 18 (unintentionally). Revision 20 was hence the direct successor of Revision 18.

Major Changes Incorporated into Revision 20

1) R29 was completely rewritten in order to substantially reduce execution time. The three main innovations were as follows: 1. R25 will not run with R29, 2. QUICTRIG replaces the call to CDUTRIG, and 3. R29 will make use of Servicer's new CSM Average-g for its LOS computation instead of making a call to KEPLER.

2) In connection with the above change, coding was added to P63 to set the NORRMON flag, thus disabling the RR angle monitor during the descent.

3) In connection with item #1, an Average-g was added to Servicer which updates the CSM state vectors in stable-member coordinates. This Average-g operates only during Descent, Ascent, and the aborts.

4) In connection with item #1, a call to CSMPREC was added to BURNBABY just prior to the call to MIDTOAVE. This CSMPREC is performed only for P63 and P12 and serves to provide initialization for the new CSM Average-g routine in Servicer.

5) Coding was added to P63 to terminate P20 or P25 in case either program was running.

6) DVMON was modified to do a STOPRATE whenever low thrust is detected. This was necessitated by the fact that FINDCDUW may leave the DAP with non-zero desired rates when it ceases to be called by guidance due to the low-thrust condition.

7) Coding was added to AVGEND to reset MUNFLAG.

8) P52 was modified to use the new erasable TALIGN. Formerly TALIGN was equated to DSPTEM1.

9) The scaling of ABDVCONV (ABDVCONV is the same kind of animal as ABDELV) was changed from 2(4) M/CS to 2(5) M/CS. Corresponding changes were made to Servicer and to the Ascent Guidance thrust-magnitude filter (ATMAG).

10) A call to STOPRATE was added to the ALLCOAST routine. This is one of several changes designed to complete the interface of FINDCDUW with the DAP (see item #6).

11) Due to a recent change to the Display Routines (the XDSPFLAG is set by each MARK display) the extended verb displays of R63 were changed to normal displays so that subsequent R60 displays would not be locked out.

12) All usages of GIMBFLG were removed. GIMBFLG was redundant since the check of APSFLAG in DVMON was sufficient for deciding whether or not to utilize the trim gimbal.

13) The erasable STOPDVC was deleted as was its usage in DVMON.

14) The LOS computation in R05 was recoded.

15) The single-precision pad-load TBRKPNT was added to the W-Matrix overlay for use by the Abort programs P70 and P71. This was made necessary by PCR 133. The current nominal value for this padload is 54000 B-17.

16) The double-precision erasable FINALT was deleted since it is not used.

17) TIG is no longer computed prior to the V16N45 display in P35 (See COLOSSUS Memo #62 item #8).

18) INITVEL was modified to use RTX1 and RTX2 instead of X1 and B29FLAG.

19) P35 was fixed to recompute a new TIG on the PROCEED response to the V16N45 display.

20) Four useless instructions were deleted from the DISPLAY ROUTINES.

21) A new subroutine (CLEARMRK) was added to FIXED-FIXED memory which sets bit 1 of FLAGWRD4 and zeros EXTVBACT, hence releasing mark displays and extended verbs.

22) PCR 130 was implemented in orbital integration. This allows coordinate center switching in backward integration.

23) Orbital integration was coded in order to prevent overflow during the J22 acceleration computation. Another modification insured that Encke deviation overflow would be detected.

24) MIDTOAVE was modified to initialize RTX1 and RTX2 properly.

25) The check for the same MM was deleted from NEWMODEX.

26) Minor coding and comment changes were made to the DOWN-TELEMETRY program for the purpose of clarification.

27) The RR angle monitor enabling and disabling logic was removed from R10 since the monitor will no longer run during the DESCENT (see item #1).

28) A program bug was fixed in CALCGRAV.

29) The definition of ACADN85 was corrected.

Major Changes Incorporated into Revision 21

30) NORMLIZE was modified to use R(CSM) and V(CSM) in its computation of UHYP instead of RRECTCSM and VRECTCSM. VHYP, which is an input to R10, is a half-unit vector in stable-member coordinates which is normal to the plane of the CSM orbit. R(CSM) and V(CSM) are the stable-member position and velocity vectors of the CSM. They are initialized by the CSMPREC in BURNBABY and updated in Servicer by RVBOTH, the new CSM Average-g which keeps track of the CSM position for R29. All of these computations are relevent to the Ascent and Descent only. (See items #1, 3, and 4)

31) A bug was fixed in the calculations following the CSMPREC in BURNBABY. TDEC1 was being destroyed by the CSMPREC and not being reloaded prior to the subsequent call to MIDTOAVE.

32) INTWAKE0 was corrected to jump around the RASFLAG check directly to INTWAKE1.

33) The improper setting of bit 2 of RASFLAG in V83 was deleted.

34) The DISPLAY ROUTINES were modified so that non-flashing R-suffix routines use NOVACS instead of FINDVACS. This eases a P20 problem.

35) ABDELV was made a single-precision erasable.

36) LRSTAT (the Landing Radar routine Flagword) was equated to FLGWRD11.

37) Nouns 19, 29, 53, 56, 59, 91, 92, and 94 were removed from PINBALL since they were no longer needed.

38) A program bug was fixed in CALCRVG. The AXC, 1 instruction should have been an LXC, 1.

39) A problem was corrected in the Landing post-touchdown coding. V37FLAG needed to be cleared when AVEGFLAG was; otherwise subsequent V37's were locked out.

40) The redesignation logic in P64 was simplified. In addition, coding was inserted into ROOTPSRS to prevent falling into an endless loop if convergence criteria could not be met.

41) The P10 and P11 pad-load TIG (AS) was deleted from Erasables and from the Downlink lists.

42) PCR 133 was implemented in P70 and P71. The pad-loaded erasable required by the PCR, TBRKPNT, had been defined in Revision 20.

43) PCR 70 was implemented in the Ascent Guidance.

44) The subroutine P20FLGON was separated from AVFLAGA and AVFLAGP. P31 was modified to make use of it, as were P32, P33, P72, and P73.

45) An engine-on command sequence in addition to several other initializations was added to the P70/P71 lead-in.

46) A number of program errors were corrected in R29.

47) A potentially dangerous divide-overflow problem was corrected in R10.

Major Changes Incorporated into Revision 22

48) Use was made of the new subroutine CLEARMRK in the AOTMARK program.

49) A scaling change was made to the deadband logic in R61.

Major Changes Incorporated into Revision 23

50) A small change was made to the Rate Derivation logic of the DAP which should eliminate occasional unnecessary jet firings.

51) Corrections were made to the displays logic in the Lunar Landing.

52) A restart bug was fixed in the S40.9-Lambert interface.

Major Changes Incorporated into Revision 24

53) Corrections were made to R29.

54) Major changes and corrections were made to R59.

55) P39 was changed to allow a computation of TIG after rather than before the first V16N45 display.

56) Use was made of P20FLGON in P34, P38, P39, and P74.

57) A program bug was fixed in TTF/8CL (a subroutine of the Descent Guidance Eqs).

58) The Landing target parameters were moved from fixed to erasable memory.

59) A problem was fixed in the area of the V06N79 display of AOTMARK. The use of CLEARMRK was incorrect and was replaced by just the clearing of XDSPFLAG.

60) RTX1 and RTX2 were made unshared erasables to eliminate erasable conflicts with the Rendezvous Guidance.

61) GUIDINIT, an initialization subroutine used by both P63 and P12, was changed to compute WM by means of RP-TO-R rather than to obtain it from WMREF. The fixed vector WMREF was also deleted. WM is used by R10, R12, and the Landing guidance. WM is the angular velocity vector of the moon in stable-member coordinates.

62) A minor correction was made to R59.

Major Changes Incorporated into Revision 25

63) A new erasable, WCHPHOLD, was defined for the Landing program to eliminate a minor display problem.

64) A correction was made to the Landing Guidance TTF/8CL Subroutine.

65) A program bug was fixed in GUIDINIT. (See item #61)

66) The new log section "CONSTANTS" was added to LUMINARY. This log section will eventually contain all fixed-memory constants that should be under GSOP control.

67) Some minor bugs were fixed in R29.

Major Changes Incorporated into Revision 26

68) The erasable TERM1TMP was equated to MPAC +3 instead of BUF2. This allows AX*SR*T to be called by means of a BANKCALL. AX*SR*T cannot be BANKCALLED in COLOSSUS, however, until the same change is made in its erasable assignments.

69) Some missing coding was inserted into P47.

70) Several coding errors were fixed and a simplification made in R05.

71) Initialization of WCHPHOLD was added to BURNBABY for P63 so that the noun 63 display from TIG to TIG +26 would function properly (see item #63).

72) R29 was modified to update its downlinked parameters with interrupt inhibited thus eliminating the problem of inconsistent data being picked up.

73) The Look-Angle computation of P64 was moved to the RGVGCALC subroutine of the Landing Guidance.

74) An error was corrected in P57.

75) A program bug was fixed in RVBOTH. (See item #3 and #30) The CSM gravity vector G(CSM) was not being updated due to a missing instruction.

76) The phase-switching logic of the Landing was corrected.

77) The Noun 49 erasables (R22DISP-R22DISP +3) were equated to TIM2SAV instead of to the DSPTEMS.

78) PINBALL was modified so that noun 4 is now identical to noun 5.

79) The Q storage register for INITVEL was changed from RTRN to NORMEX, and the Q storage register for S34/S35.2 was changed from NORMEX to SUBEXIT. This resolved a P31 restart problem since INITVEL was destroying the Q storage register of a preceding subroutine that put up a normal flashing display.

Available Erasables in LUMINARY Revision 26

Unswitched	11
E3	8
E4	8
E5	2
E6	7
E7	8

Summary of Assemblies

Revision	Status	Word Count	Tapes
20	BAD, 15 cusses	34329	None
21	BAD, 25 cusses	34352	None
22	BAD, 2 cusses	34352	None
23	GOOD	34340	LMS, HYBRID
24	BAD, 112 cusses	34281	None
25	GOOD	34279	None
26	GOOD	34275	LMS, HYBRID

Statistical Summary for Revisions 19-26

1)	Number of modification forms	144
2)	Number of DAP changes	2
3)	Changes for storage reduction	12
4)	Changes for execution time reduction	2
5)	Developmental changes	36
6)	Non-program changes	29
7)	Mandatory changes	65
8)	Total fixed memory change	-54

Index to PCR's and PCN's Implemented in Revisions 19-26

Subject	Item #
1) PCR 133	15, 42
2) PCR 130	22
3) PCR 70	43